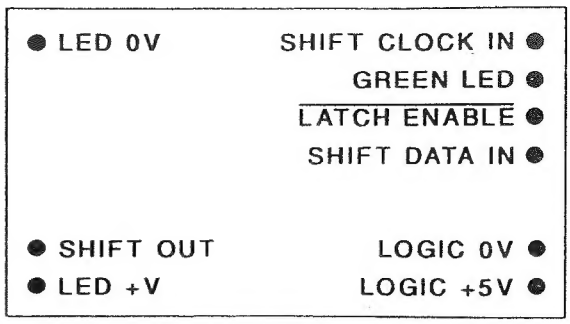
LED MODULE

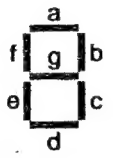
This appears to be a multiplexed 7 digit 7 segment display, driven by a 16 bit shift register. The display does NOT have decimal points. There are three LEDs below the 7 segment display. The green can be controlled directly by the GREEN LED pin while the red and yellow are driven from the shift register. The display does not multiplex itself and it is up to the system supplying the data to continuously load the shift register with the segment pattern for each digit in turn. The digit to be driven is also selected by setting the appropriate bit in the shift register.



LOOKING AT REAR OF MODULE

If you take the first bit shifted in to the shift register as bit 15 and the last bit shifted in as bit 0 then the following table shows the correspondence between the 16 shift register bits and the segment/digit/LED that they each control:-

bit 15	yellow LED
bit 14	red LED
bit 13	digit 7 (most significant)
bit 12	digit 6
bit 11	digit 5
bit 10	digit 4
bit 9	digit 3
bit 8	digit 2
bit 7	digit 1 (least significant)
bit 6	segment a
bit 5	segment b
bit 4	segment c
bit 3	segment d
bit 2	segment e
bit 1	segment f
bit 0	segment g

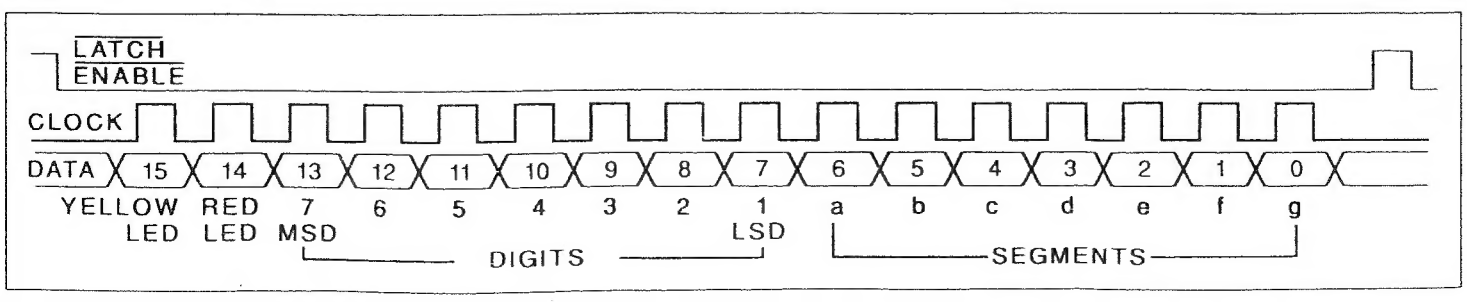


To connect the display to a microcontroller or computer port you need three port bits (one more if you want to control the green LED). The sequence of software events to output the number 24 with the red LED lit would be as follows:-

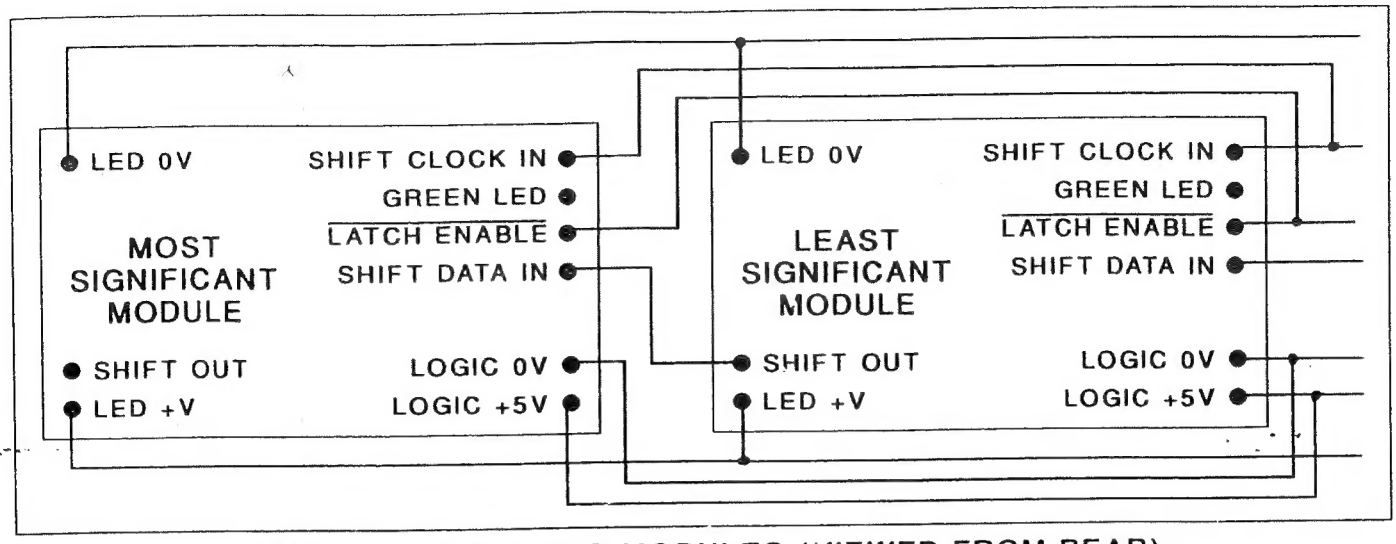
1 Clear a couple of 8 bit memory locations or one 16 bit memory location.
2 Ensure LATCH ENABLE is LOW.
3 Look up the segment pattern for the number 4 which is 0110011 and put that in the least significant byte or the lower half of the 16 bit word.
4 Find the bit corresponding to the digit to be illuminated, in this case 00000000 10000000 and OR it with the byte or word that already contains the segment pattern.
5 Find the bit corresponding to the red LED which is bit 14 01000000 00000000 and OR that with the other display data so far.
6 Ensure SHIFT CLOCK IN is LOW.
7 Rotate the two 8 bit bytes or 16 bit word to the left and place the bit that comes out of the most significant bit on SHIFT DATA IN. If using two 8 bit bytes, ensure that bit 7 from the least significant byte is transferred to bit 0 of the most significant byte during the shift.
8 Take SHIFT CLOCK IN line HIGH then LOW allowing the line to remain high for a suitable period if you have a very fast system.
9 Repeat steps 7 and 8 a total of sixteen times. At this point the shift register is fully loaded.
10 Take LATCH ENABLE line HIGH then LOW allowing the line to remain high for a suitable period if you have a very fast system. This will transfer the new data to the display drivers.
11 Wait x milliseconds to allow the digit to be seen. This time should be equal for each digit otherwise some digits will appear brighter than others.
12 Clear the memory locations ready for the next digit.
13 Look up the segment pattern for the number 2 which is 1101101 and put that in the least significant byte or the lower half of the 16 bit word.
14 Find the bit corresponding to the digit to be illuminated, this time it is 00000001 00000000 and OR it with the byte or word that already contains the segment pattern. It does not make any sense to set more than one digit bit at a time.
15 Find the bit corresponding to the red LED which is bit 14 01000000 00000000 and OR that with the other display data so far. Although these LEDs are not multiplexed, if you set the bits appropriately each time you do a digit they will appear brighter than if you set them only when you do a particular digit.
16 Go back to step 7 doing each digit in turn.

The GREEN LED input is a logic input and may be connected directly to a microcontroller I/O port bit.

The following shows the relationship between SHIFT CLOCK, SHIFT DATA and LATCH ENABLE. Note that the data changes while clock is low and this seems to work but it could be that the data needs to change when clock is high.



SHIFT OUT reflects the state of bit 15 (the bit connected to the green LED - not the actual state of the green LED though). This may be used to chain modules together. By connecting SHIFT OUT on the first module to SHIFT DATA IN on the next a 32 bit shift register is created. If the two displays are mounted side by side a 14 digit display could be created. You need to create 32 bits of data and shift it out before taking LATCH ENABLE high. Since both modules are showing one digit each during the multiplexing process, the display is no dimmer than one module alone.

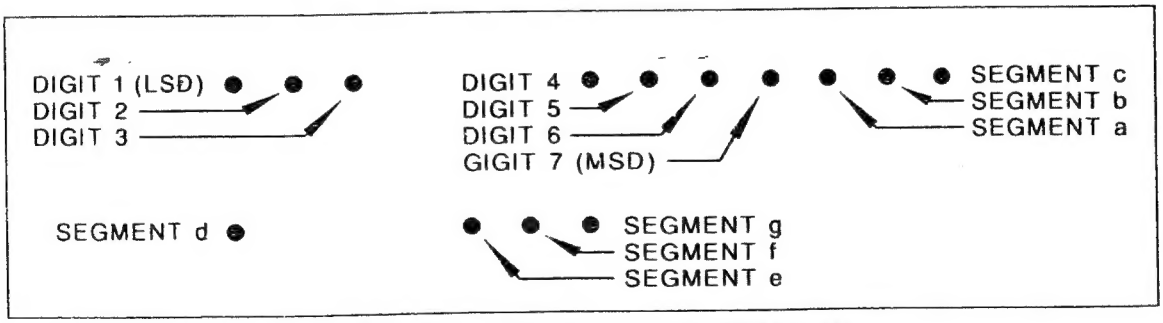


DAISY CHAINING TWO MODULES (VIEWED FROM REAR)

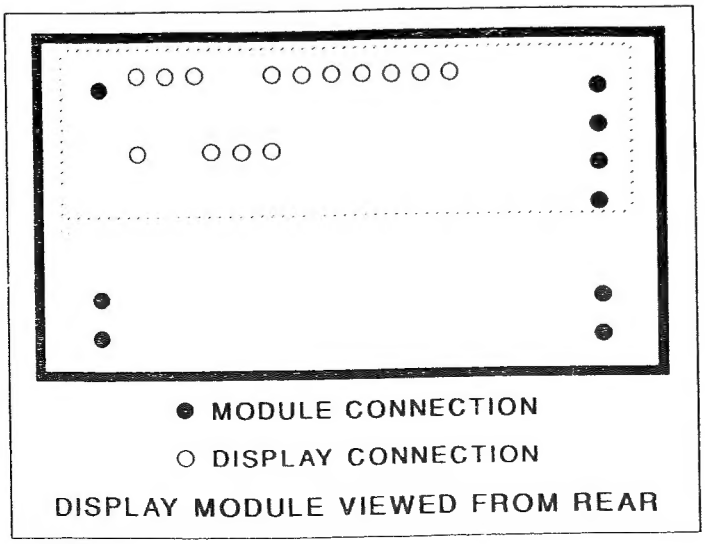
The 7 seqment display can be desoldered from the PCB and used alone. It appears to be a 7 digit 7 segment common anode multiplexed display. The PCB it is soldered to is double sided and great care is required to ensure all the display pins are loose before trying to remove it. The light from the LEDs is guided to the 7 segments at the display front by soft rubber. If this rubber is pulled out of position, the appearance of the display will be ruined. The actual LEDs are mounted on a firm PCB and produce points of light in the absence of the rubber.

The diagram below shows the pinout of the display:-

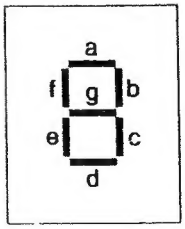
Each of the connections marked "DIGIT" is a common anode. Each of the connections marked "SEGMENT" is a cathode. The display does not have any decimal points.



LOOKING AT REAR OF DISPLAY



DISPLAY MODULE VIEWED FROM REAR



SEGMENT NOTATION